DelDOT
Delaware Department of Transportation

PARK AVENUE RELOCATION

AIR QUALITY TECHNICAL REPORT

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PARK AVENUE RELOCATION

Park Avenue Relocation Air Quality Technical Report

Delaware Department of Transportation (DelDOT)

Town of Georgetown in Sussex County, Delaware
Project Number: T201304601
Federal Project Number: STP-S318(03)

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Acronyms

AADT	Annual Average Daily Traffic
ADT	Average Daily Traffic
CAA	Clean Air Act
CAAA	Clean Air Act Amendments
CEQ	Council on Environmental Quality
CLRP	Constrained Long Range Plan
CO	Carbon Monoxide
CFR	Code of Federal Regulations
DelDOT	Delaware Department of Transportation
DAQ	Division of Air Quality
DNREC	Division of Natural Resources and Environmental Control
EA	Environmental Assessment
EIS	Environmental Impact Statement
EO	Executive Order
EPA	Environmental Protection Agency
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
FY	Fiscal Year
GHG	Greenhouse Gas
HAP	Hazardous Air Pollutant
HEI	Health Effects Institute
IRIS	Integrated Risk Information System
LOS	Level of Service
MOVES2014a	Motor Vehicle Emissions Simulator (Version 2014a)
MSAT	Mobile Source Air Toxics
NAAQS	National Ambient Air Quality Standards
NATA	National Air Toxics Assessment
NCHRP	National Cooperative Highway Research Program
NEPA	National Environmental Policy Act
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxide
O_3	Ozone
Pb	Lead
POM	Polycyclic Organic Matter
PM_{10}	Particulate Matter 10 microns in size or less
$PM_{2.5}$	Particulate Matter 2.5 microns in size or less
ROFA	Runway Object Free Area
RPZ	Runway Protection Zone
SO_2	Sulfur Dioxide
VMT	Vehicle Miles Traveled
VOC	Volatile Organic Compound

1.0 Introduction

The Delaware Department of Transportation (DelDOT), in cooperation with the Federal Highway Administration (FHWA), is evaluating the relocation and upgrade of Park Avenue in the southern portion of the Georgetown area in Sussex County, Delaware. Pursuant to the National Environmental Policy Act of 1969 (NEPA), as amended, and in accordance with FHWA regulations, an Environmental Assessment (EA) has been prepared to analyze and document the potential social, economic, and environmental effects associated with the proposed transportation improvements.

The purpose of this Technical Report is to identify and assess potential air quality impacts associated with the Preferred Alternative. Information in this report, described below, supports discussions presented in the EA.

- **Section 1** provides an overview of the study and Purpose and Need of the project;
- **Section 2** describes the regulatory requirements;
- **Section 3** describes the existing conditions of the Study Area;
- **Section 4** summarizes the assessment of the project with regards to CO and MSATs; and
- **Section 5** describes the analysis of construction emissions.

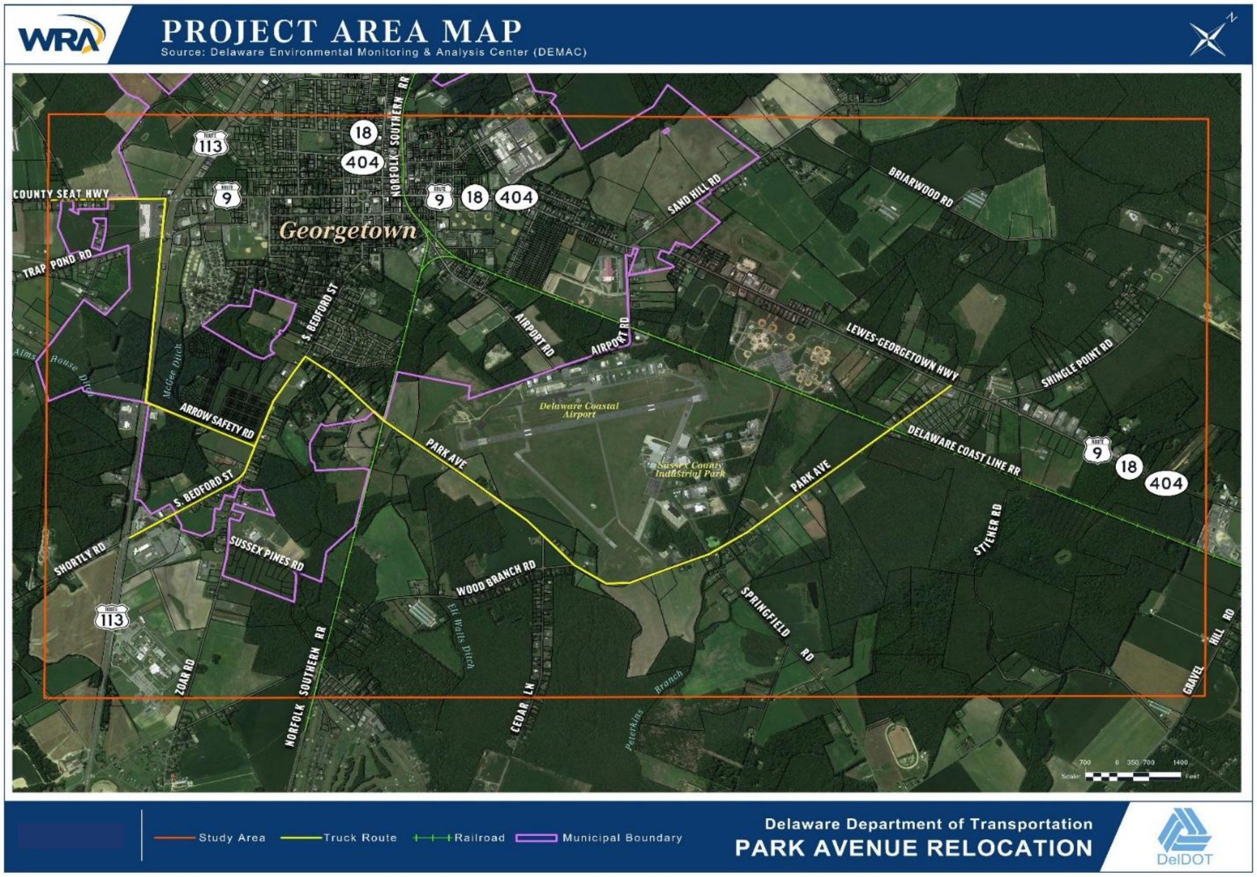
1.1 Description of the Study Area

The project's Study Area extends from one-half-mile east of Park Avenue to one-quarter-mile west of US 113, and includes the majority of the Town of Georgetown, the Delaware Coastal Airport, and the Sussex County Industrial Park (refer to **Figure 1-1**). The Study Area was developed based upon review of the land use in the area. The area in the vicinity and to the south of Park Avenue, South Bedford Street, and Arrow Safety Road is predominantly industrial or is planned to be industrial with pockets of residences, farmland, wetlands, and forested areas, as well as a new residential development planned north of Arrow Safety Road. The roadways further south of Park Avenue and South Bedford Street, such as Wood Branch Road, support low density residential development. Residential mixed with commercial uses border US 9 and DuPont Boulevard (US 113); while the majority of the vacant developable land between these roadways is designated for future residential development (Sussex County, 2008).

1.2 Background

Park Avenue, also known as US Route 9 Truck Bypass, is the designated truck route for tractor trailers moving through the area, providing access to the Sussex County Industrial Park, southeast of the Delaware Coastal Airport. Sussex County's 2017-2022 Capital Transportation Program Request has identified Park Avenue as a priority for improvement (Sussex County, 2015). DelDOT's Capital Transportation Plan for fiscal year (FY) 2017-2022, the currently approved plan, authorizes funding for preliminary engineering and right-of-way for the project (DelDOT, 2017). The report and plan note that the roads used for the truck bypass should be upgraded, with appropriate turn lanes and signalized intersections, and that the truck route should be realigned, removing the truck route from the existing residential areas of Park Avenue and South Bedford Street (Sussex County, 2015 and DelDOT, 2017).

Figure 1-1: Project Area Map



1.3 Existing Conditions

US 9 travels through the Town of Georgetown connecting Laurel, Delaware with Lewes, Delaware. West of US 113, US 9 is known as County Seat Highway; east of US 113, US 9 is known as Lewes-Georgetown Highway (refer to **Figure 1-1**). To eliminate truck traffic through the center of Georgetown, DelDOT designated a truck bypass which begins at County Seat Highway (US 9) west of Georgetown, then follows US 113, Road 87 (Arrow Safety Road), Road 431 (South Bedford Street), and Park Avenue, and reconnects with Lewes-Georgetown Highway (US 9) east of Georgetown. The five-mile bypass requires that trucks turn at five intersections and cross two railroads at-grade, the Norfolk Southern Line east of South Bedford Street on Park Avenue and the Delaware Coast Line south of Lewes-Georgetown Highway (US 9) on Park Avenue. The bypass is the only access route to the Sussex County Industrial Park and is a main route to the Delaware Coastal Airport (formerly the Sussex County Airport).

1.4 Purpose and Need

The purpose of the Park Avenue relocation, being undertaken by DelDOT, is to improve the traffic operations and safety of the US 9 truck bypass from east of Georgetown to US 113.

The primary need for the Park Avenue project is to improve traffic operations and safety. The existing truck route between US 9 and US 113 has several turning movements that hinder traffic operations, the roadway width is narrow and does not meet current design for a truck route, and the average number of crashes along the truck route between US 113 and US 9 is higher than the state and Sussex County averages.

Secondary needs are to support economic growth and to support federal, state, and local initiatives by focusing on improving transportation infrastructure to provide safe and convenient road access across the region and to areas zoned for business/industrial use.

1.5 Alternatives Considered for Evaluation

Conceptual alternatives that could potentially address the Purpose and Need for study were developed and then screened and compared by DelDOT during the conceptual design phase based on criteria developed to determine whether or not the identified elements of Purpose and Need would be met. The alternatives evaluated as well as the screening criteria are described in **Chapter 2.0** of the EA. Following is a description of the two alternatives carried forward for evaluation.

1.5.1 No-Build Alternative

Under the No-Build Alternative, no improvements to or relocation of Park Avenue would be undertaken; however, routine maintenance of the US 9 truck route would continue. The No-Build Alternative would not satisfy the identified needs of the project as it would not improve traffic operations and safety along Park Avenue. The No-Build Alternative is also inconsistent with local plans and would not accommodate growth at the Delaware Coastal Airport (Town of Georgetown, 2010; Sussex County, 2008, 2015, and 2016). The No-Build Alternative has been carried forward in this EA as a benchmark for assessing the transportation benefits and environmental impacts of Build Alternative 6, the Preferred Alternative.

1.5.2 Preferred Alternative

The Preferred Alternative would begin at Arrow Safety Road and straighten the alignment of the truck bypass by creating an additional leg at the intersection with South Bedford Street. The alternative would then travel along a new alignment to connect to Park Avenue east of the Norfolk Southern Railroad tracks. This alternative would avoid the runway object free area (ROFA) as well as the central portion of the runway protection zone (RPZ) associated with the proposed growth of the Delaware Coastal Airport, and minimize wetland impacts.

This truck route relocation would improve traffic operations by improving the roadway alignment and typical section, providing a continuous route around Georgetown, connecting US 113 west of Georgetown to US 9 east of Georgetown, and improving the Park Avenue and US 9 intersection and the Park Avenue and South Bedford Street/Arrow Safety Road intersection. The Preferred Alternative is consistent with local plans and allows for the future growth of the Delaware Coastal Airport as proposed by Sussex County, thus potentially encouraging economic development in the region (Town of Georgetown, 2010; Sussex County, 2008, 2015, and 2016).

2.0 Regulatory Requirements

This section provides an overview of regulations and guidance applicable to the project-level air quality analysis.

2.1 National Environmental Policy Act

Federal funding is involved with the project; therefore, compliance with NEPA and the Clean Air Act and Amendments (CAAA) is required. Air quality is an environmental concern within the broad purview of NEPA. The requirements of NEPA have been defined in the Council of Environmental Quality's (CEQ) NEPA regulations that apply to all federal agencies and the FHWA /Federal Transit Administration (FTA) joint NEPA procedures. The text of the NEPA statute, the CEQ NEPA regulations (40 CFR 1500) and FHWA's NEPA regulations (23 CFR 771) however do not contain specific requirements for air quality analyses. For air quality, FHWA has issued guidance for Carbon Monoxide (CO) and Mobile Source Air Toxics (MSAT) analyses.

2.2 Carbon Monoxide

In 1987, FHWA issued a Technical Advisory providing guidance for preparing and processing of environmental impacts for EAs and Environmental Impact Statements (EISs) under NEPA (FHWA, 1987). Section V(G)(8) pertains to air quality including a summary of the project-related CO analysis. Two types of analyses are discussed: mesoscale and microscale. The mesoscale analysis is a regional analysis consisting of nitrogen oxide (NO_x), ozone (O_3) and hydrocarbons. Where these pollutants are an issue, a mesoscale analysis may be undertaken to evaluate the regional impacts of the project. A microscale analysis is a localized study where air quality dispersion modeling may be required to demonstrate that project-related CO impacts are below the National Ambient Air Quality Standards (NAAQS).

2.3 Mobile Source Air Toxics

On October 18, 2016, FHWA issued updated interim guidance regarding MSATs in a NEPA analysis to include the Environmental Protection Agency's (EPA) recent Motor Vehicle Emissions Simulator (MOVES) Version 2014a emission model along with updated research on air toxic emissions from mobile sources (FHWA, 2016b).

The EPA identified nine compounds with significant contributions from mobile sources that are among the national and regional-scale cancer drivers from their 1999 National Air Toxics Assessment. The nine compounds identified were: acetaldehyde, acrolein; benzene; 1, 3-butadiene; diesel particulate matter plus diesel exhaust organic gases; ethylbenzene, formaldehyde; naphthalene; and polycyclic organic matter (POM). While FHWA considers these the priority MSATs, the list is subject to change and may be adjusted in consideration of future EPA rules.

The FHWA guidance of October 18, 2016, presents a tiered approach for assessing MSATs in NEPA documents. The three levels are for projects with 1) no meaningful MSAT effects, 2) low potential MSAT effects, and 3) high potential MSAT effects, respectively. The FHWA guidance defines the levels of analysis for each type of MSAT effect:

- No analysis for projects with no potential for meaningful MSAT effects;
- A qualitative analysis for projects with low potential MSAT effects; and
- A quantitative analysis for projects with high potential MSAT effects.

The Preferred Alternative was evaluated against each threshold criteria in order to determine the type of MSAT analysis required to satisfy NEPA.

2.4 Particulate Matter

The study area is located in an area that is designated as attainment for PM_{10} and $PM_{2.5}$ NAAQS; therefore, transportation conformity requirements pertaining to particulate matter do not apply for this project.

2.5 Clean Air Act

2.5.1 National/State Ambient Air Quality Standards

Pursuant to the Federal Clean Air Act of 1970 (CAA), the EPA established NAAQS for major pollutants known as "criteria pollutants." Currently, the EPA regulates six criteria pollutants: ozone (O_3), CO, nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter (PM), and lead (Pb). PM is divided into two particle size categories: particles with a diameter less than 10 micrometers (PM_{10}) and those with a diameter of less than 2.5 micrometers ($PM_{2.5}$). **Table 2-1** shows the primary and secondary NAAQS for the criteria pollutants. The NAAQS are two-tiered: the first tier (primary) is intended to protect public health; the second tier (secondary) is intended to protect public welfare and prevent degradation of the environment. Delaware has adopted the Federal NAAQS for all pollutants and has retained the 1-hour ozone standard of 0.12 ppm which was revoked by EPA in June of 2005 along with the 24-hour and annual SO_2 standard which were revoked by the EPA in 2010.

Table 2-1: National/State Ambient Air Quality Standards

Pollutant		Primary/ Secondary	Averaging Time	Level	Form
Carbon Monoxide (CO)		primary	8 hours	9 ppm	Not to be exceeded more than once per year
			1 hour	35 ppm	
Lead (Pb)		primary and secondary	Rolling 3 month average	0.15 μg/m^3 (1)	Not to be exceeded
Nitrogen Dioxide (NO2)		primary	1 hour	100 ppb	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		primary and secondary	1 year	53 ppb (2)	Annual Mean
Ozone (O_3)		primary and secondary	8 hours	0.070 ppm (3)	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years
		Primary	1 hour	0.120 ppm (5)	Number of Days averaged over 3 years
Particle Pollution	$PM_{2.5}$	primary	1 year	12.0 μg/m^3	annual mean, averaged over 3 years
		secondary	1 year	15.0 μg/m^3	annual mean, averaged over 3 years
		primary and secondary	24 hours	35 μg/m^3	98th percentile, averaged over 3 years
	PM_{10}	primary and secondary	24 hours	150 μg/m^3	Not to be exceeded more than once per year on average over 3 years
Sulfur Dioxide (SO_2)		primary	1 hour	75 ppb (4)	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		secondary	3 hours	0.5 ppm	Not to be exceeded more than once per year
		Primary	24 hours	0.14 ppm	Not to be exceeded more than once per year
		Primary	Annual	0.03 ppm	Shall not be exceeded

Notes:

(1) In areas designated nonattainment for the Pb standards prior to the promulgation of the current (2008) standards, and for which implementation plans to attain or maintain the current (2008) standards have not been submitted and approved, the previous standards (1.5 µg/m3 as a calendar quarter average) also remain in effect.

(2) The level of the annual NO2 standard is 0.053 ppm. It is shown here in terms of ppb for the purposes of clearer comparison to the 1-hour standard level.

(3) Final rule signed October 1, 2015, and effective December 28, 2015. The previous (2008) O3 standards additionally remain in effect in some areas. Revocation of the previous (2008) O3 standards and transitioning to the current (2015) standards will be addressed in the implementation rule for the current standards.

(4) The previous SO2 standards (0.14 ppm 24-hour and 0.03 ppm annual) will additionally remain in effect in certain areas: (1) any area for which it is not yet 1 year since the effective date of designation under the current (2010) standards, and (2)any area for which an implementation plan providing for attainment of the current (2010) standard has not been submitted and approved and which is designated nonattainment under the previous SO2 standards or is not meeting the requirements of a SIP call under the previous SO2 standards (40 CFR 50.4(3)). A SIP call is an EPA action requiring a state to resubmit all or part of its State Implementation Plan to demonstrate attainment of the required NAAQS.

(5) The one-hour standard is achieved when the expected number of days, averaged over three years, with a maximum hourly average of greater than 0.12 ppm (235 µg/m3) is less than or equal to one.

Source: https://www.epa.gov/criteria-air-pollutants/naaqs-table (accessed on August 28, 2017) and Delaware Regulation 1103.

Section 176(c) of the CAA requires federal agencies to ensure that all of their actions conform to applicable implementation plans for achieving and maintaining the NAAQS. Federal actions must not cause or contribute to any new violation of any standard, increase the frequency or severity of any existing violation, or delay timely attainment of any standard.

The NAAQS apply to the concentration of a pollutant in outdoor ambient air. If the air quality in a geographic area is equal to, or is better than the national standard, EPA will designate the region as an attainment area. Areas where air quality does not meet the national standards are designated as non-attainment areas. Once the air quality in a non-attainment area improves to the point where it meets the standards and the additional redesignation requirements in the CAA [Section 107(d)(3)(E)], EPA may redesignate the area as an attainment/maintenance area, which are typically referred to as "maintenance areas."

The CAA requires EPA to designate the status of all areas as being in or out of compliance with the NAAQS. The CAA further defines non-attainment areas for ozone based on the severity of the violation as marginal, moderate, serious, severe, and extreme.

2.6 Description of Project Level Pollutants

CO is a toxic colorless and odorless gas that results from the incomplete combustion of gasoline and other fossil fuels. Because CO disperses quickly, the concentrations can vary greatly over relatively short distances. Relatively high concentrations of CO may occur near congested intersections, along heavily used roadways conveying slow-moving traffic, and in areas where atmospheric dispersion is inhibited by urban "street canyon" conditions.

PM is a broad class of air pollutants that exists as liquid droplets or solids, with a wide range of size and chemical composition. It is emitted by a variety of sources, both natural and man-made. Major man-made sources of PM include the combustion of fossil fuels in vehicles, power plants and homes, construction activities, agricultural activities, and wood-burning fireplaces. Smaller particulates less than or equal to 10 and 2.5 microns in size (PM_{10} and $PM_{2.5}$) are of particular health concern because they can get deeper into the lungs and affect respiratory and heart function.

Toxic air pollutants, also known as air toxics, are pollutants that at sufficient concentrations and exposure, are known or suspected to cause cancer or other serious health effects, or to cause adverse environmental effects. Delaware began developing a routine ambient air-sampling program for selected volatile organic compounds (VOCs). In 2000 this program was updated by changing the sampling and analytical method to detect a greater number of VOCs. In 2003, the program was expanded to include other types of chemical compounds such as carbonyls and heavy metals (DNREC, 2015). Air toxics can be released from natural sources, including volcanic eruptions and forest fires, but most of these pollutants come from human activity including:

- On-Road Mobile Sources including cars, trucks and buses
- Off-Road Mobile Sources such as outdoor power equipment, recreational vehicles, farm and construction equipment, boats, and locomotives
- Stationary Sources including factories, refineries and power plants
- Indoor Sources such as building materials and cleaning solvents

2.7 Transportation Conformity

EPA promulgated the transportation conformity rule (40 CFR Parts 51 and 93) pursuant to requirements of the CAA. The rule **only** applies in EPA designated non-attainment or maintenance areas for PM (40 CFR 93.102(b)) (EPA, 2015a). As discussed further in **Section 3.1**, the Project is located in an attainment area for PM; therefore, Transportation Conformity does not apply.

2.8 Climate Change and Greenhouse Gas Impacts

On August 2, 2016, CEQ published a final version of its guidance to federal agencies requiring the consideration of greenhouse gas (GHG) emissions and effects on climate change when evaluating potential impacts of a federal action under NEPA (CEQ, 2016). Most recently, President Trump signed an Executive Order (EO) on March 28, 2017 on Promoting Energy Independence and Economic Growth (whitehouse.gov, 2017). Section 3(c) of the EO directs the CEQ to rescind the "Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews." With the recent withdrawal of federal guidance addressing greenhouse gas analyses and climate change, a GHG analysis was not conducted for this project (CEQ, 2017).

3.0 Existing Conditions

3.1 Air Quality Attainment Status of the Region

The EPA Green Book, which lists non-attainment, maintenance, and attainment areas, was reviewed to determine the designation for the Georgetown area. The EPA Green Book shows that Sussex County is designated as being in attainment for all of the NAAQS except the 2008 8-hour ozone standard, which is designated as being non-attainment (EPA, 2017c). The previous 1979 1-hour and 1997 8-hour ozone non-attainment designations were revoked by EPA.

3.2 Climate and Meteorology

Georgetown is located in the southern portion of the state with the Atlantic Ocean approximately 16 miles to the east and the Chesapeake Bay approximately 40 miles to the west. The climate of the area is typical of Mid-Atlantic locations near bodies of water. The area exhibits four distinct seasons, where winters are mild with limited snowfall and summers are hot and humid. Based on data provided by the National Weather Service from the closest most representative location to Georgetown that keeps climate records, the average annual temperature for nearby Greenwood, Delaware is 54.9 degrees Fahrenheit. The area typically receives 46.41 inches of rainfall annually and up to 16 inches of snow during the winter months (National Weather Forecast, 2017).

3.3 Ambient Air Quality Data and Trends

The state of Delaware has established air-monitoring networks to measure ambient levels of pollutants for which NAAQS have been established. The network is maintained and operated by the Division of Natural Resources and Environmental Control (DNREC) Air Monitoring Program within the Planning Branch of the Division of Air Quality (DAQ). Over the last ten years, the trends in the monitoring results show that ambient air pollutant concentrations have been steady or declining.

To characterize the air quality of the study area, air quality data from the EPA Monitor Values Report (which collects data from monitored networks in Delaware) were reviewed at the closest most representative monitoring stations to the Georgetown area for the most recent three-year period available (2014 to 2016) (EPA, 2017e). The closest most representative monitor stations were Seaford ($PM_{2.5}$ and Ozone), Lewes (SO_2), and Wilmington (NO_x and CO). The data from these measurement locations are considered reasonably representative of the project site and were used to determine air quality within the Project area. **Table 3-1** presents the monitored data for the 2014 to 2016 period from each of the representative measurement locations.

Table 3-1: Ambient Air Quality Monitoring Data (2014 to 2016)

Pollutant	Location	Averaging Period	2014	2015	2016	NAAQS
CO	Wilmington-MLK	1-Hour Max	1.7	1.5	1.5	35 ppm
		1-Hour 2nd Max	1.4	1.5	1.5	35 ppm
		8-Hour Max	1.1	1.2	1.4	9 ppm
		8-Hour 2nd Max	1.0	1.2	1.2	9 ppm
		Exceedances	0	0	0	
$PM_{2.5}$	Seaford	24-Hour 98th Percentile	22 μg/ m^3	23 μg/ m^3	16 μg/ m^3	35 μg/ m^3
		Mean Annual	9.4μg/ m^3	8.8μg/ m^3	7.3μg/ m^3	12μg/ m^3
		Exceedances	0	0	0	
Ozone	Seaford	1-Hour Max	0.078	0.082	0.085	0.120 ppm
		1-Hour 2nd Max	0.075	0.081	0.083	0.120 ppm
		Exceedances	0	0	0	
		8-Hour Max	0.072	0.075	0.079	0.070 ppm
		8-Hour 2nd Max	0.070	0.073	0.077	0.070 ppm
		8-Hour 3rd Max	0.067	0.072	0.071	0.070 ppm
		8-Hour 4th Max	0.067	0.070	0.070	0.070 ppm
		Exceedances	1	3	3	
NO_2	Wilmington-MLK	1-Hour Max	40	52	62	100 ppb
		1-Hour 2nd Max	29	51	57	100 ppb
		Annual Mean	2.6	12.2	11.6	53 ppb
		Exceedances	0	0	0	
SO_2	Lewes	1-Hour Max	12	11.9	4.2	75 ppb
		1-Hour 2nd Max	7.1	8.1	2.2	75 ppb
		24-Hour Max	3.7	3.6	0.9	140 ppb
		24-Hour 2nd Max	2.9	2.0	0.9	140 ppb
		Annual Mean	0.37	0.19	0.09	30 ppb
		Exceedances	0	0	0	

Source:https://www.epa.gov/outdoor-air-quality-data/monitor-values-report

The measured levels from the DAQ monitoring stations are all below the NAAQS except for the 8-hour ozone at Seaford. These exceedances occur mostly during the summer time when hot dry weather and stagnant air conditions are conducive to ozone formation. It should be noted that while there was measured exceedances of the 8-hour standard of 0.070 ppm; no violations of the standard have been reported at the Seaford monitor location in the recent three-year data set (2014 thru 2016).

4.0 Project Assessment

Project-level analyses for highway projects typically consist of evaluations of CO, PM, and MSATs. Since the project is located in an attainment area for PM, Transportation Conformity does not apply and only CO and MSATs were evaluated. As discussed below, the methodologies and assumptions used in the analysis for each pollutant are consistent with FHWA and EPA guidance. Traffic forecasts for the Study Alternatives were developed for the Existing (2014) and Design Year (2040) Preferred and No-Build Alternatives.

4.1 Carbon Monoxide (CO) Analysis

A review of the Level of Service (LOS) at the studied intersections along with the forecast average annual daily traffic (AADT) for the Preferred and No-Build Alternatives show no meaningful changes in traffic volumes, vehicular mix, change in location; or any other significant factor that would cause an increase in CO emissions or ground level concentrations compared to the No-Build Alternative.

Additional details supporting these conclusions are presented below:

Comparison of average annual daily volumes and peak hour Level of Service (LOS) are included in **Table 4-1, Table 4-2** and **Table 4-3,** respectively, for the No-Build and Preferred Alternatives. As shown in **Table 4-1**, the Preferred Alternative results in some redistribution of traffic associated with the project improvements from the following links:

- US 113, Shortly Road to Arrow Safety Road;
- South Bedford Street, US 113 to Zoar Road;
- South Bedford Street, Zoar Road to Park Avenue;
- Arrow Safety Road, US 113 to South Bedford Street; and
- Zoar Road, south of South Bedford Street.

Although redistribution of traffic is expected, traffic volumes would not increase with the Preferred Alternative compared to the No-Build and the vehicle mix would remain the same between the Preferred Alternative and the No-Build Alternative. As shown in **Table 4-1**, the total AADT expected for the No-Build Alternative and Preferred Alternative is 166,000 and 165,300, respectively. In general, the average annual daily traffic volumes are essentially the same at most roadway links with the exception of those links identified above. Some links show an overall net benefit of 700 fewer vehicles (approximately 49 fewer diesel trucks) under the Preferred Alternative.

Similarly, as shown in **Table 4-2** and **Table 4-3**, the LOS is expected to remain the same or improve under the Preferred Alternative with the proposed improvements when compared to the No-Build. More specifically, delay times are expected to remain the same or decrease at many of the approach movements, thereby reducing idling time. Likewise, the LOS for the Preferred Alternative with the proposed improvements is generally the same or lower compared to the No-Build Alternative. The proposed improvements would allow for more efficient vehicle travel (i.e. higher vehicle speeds) and reduced idling time through the intersections.

In summary, this analysis demonstrates that the Preferred Alternative with the proposed improvements would not be the worst case and would not add any additional vehicular traffic or change the vehicle fleet mix compared to the No-Build Alternative. Daily traffic volumes, including diesel vehicles are essentially the same if not lower and LOS and delay times will be the same or reduced at many locations compared to the No-Build Alternative. Therefore, it can reasonably be concluded the Project is not expected to increase CO emissions or impacts compared to the No-Build Alternative. With these conclusions coupled with monitored CO background values in the area being well below the NAAQS (refer to **Table 3-1)**, the project is not expected to significantly impact air quality and would not cause or contribute to a new violation the CO NAAQS.

Table 4-1: Park Avenue Relocation Average Annual Daily Traffic (AADT) Summary

Road Name	Percent Diesel Trucks	2014 (Existing) AADT	2040 No-Build AADT	2040 Preferred AADT	Delta Change	2040 No-Build AADT Diesel Trucks	2040 Preferred AADT Diesel Trucks
US 113, south of Shortly Road	15	23,900	29,400	29,400	0	4,410	4,410
US 113, Shortly Road to Arrow Safety Road	15	28,100	35,500	36,200	700	5,325	5,430
US 113, north of Arrow Safety Road	15	22,200	28,800	28,800	0	4,320	4,320
South Bedford Street, US 113 to Zoar Road	11	7,400	10,600	9,000	-1,600	1,166	990
South Bedford Street, Zoar Road to Park Avenue	11	9,250	12,300	11,300	-1,000	1,353	1,243
South Bedford Street, north of Park Avenue	11	8,200	10,600	10,600	0	1,166	1,166
Arrow Safety Road, US 113 to South Bedford Street	11	20,753	3,500	5,900	2,400	385	649
Zoar Road, south of South Bedford Street	11	3,800	5,900	4,700	-1,200	649	517
Park Avenue (US 9 Truck), east of South Bedford Street	14	5,425	8,400	8,400	0	1,176	1,176
Park Avenue (US 9 Truck), south of US 9	14	3,800	4,700	4,700	0	658	658
US 9	7	14,270	16,300	16,300	0	1,141	1,141
Total		147,098	166,000	165,300	-700	21,749	21,700

Table 4-2: Park Avenue Improvement/Relocation LOS Summary Existing and No-Build Alternative

Intersection	Approach/ Movement(s)	Existing Conditions				2040 No-Build Conditions			
		Delay (sec)		Level of Service		Delay (sec)		Level of Service	
		AM	PM	AM	PM	AM	PM	AM	PM
Signalized Intersections									
US 113 at Shortly Road / South Bedford Street	Eastbound	88.1	67.4	F	E	172.6	77.2	F	E
	Westbound	64.9	70.1	E	E	66.3	113.2	E	F
	Northbound	29.2	35.2	C	D	43.5	48.9	D	D
	Southbound	26.7	56.3	C	E	33.9	100.7	C	F
	Overall Int.	35.9	51.0	D	D	53.9	83.2	D	F
US 113 at Arrow Safety Road	Eastbound	69.3	84.0	E	F	54.8	102.0	D	F
	Westbound	86.0	104.5	F	F	94.1	85.1	F	F
	Northbound	22.6	23.9	C	C	45.8	46.9	D	D
	Southbound	16.3	11.0	B	B	29.0	18.9	C	B
	Overall Int.	26.4	22.2	C	C	44.4	36.2	D	D
US 9 at Park Avenue	Eastbound	6.4	7.9	A	A	7.6	10.3	A	B
	Westbound	29.4	29.9	C	C	142.4	218.0	F	F
	Northbound	25.8	24.6	C	C	25.9	26.2	C	C
	Overall Int.	20.5	19.9	C	B	78.8	99.1	E	F
Unsignalized Intersections									
South Bedford Street at Zoar Road	Zoar Road Through/Left	26.0	15.7	D	C	294.2	70.6	F	F
	Southbound Left	8.9	8.8	A	A	10.2	10.1	B	B
South Bedford Street at Arrow Safety Road	Eastbound	24.4	21.2	C	C	225.2	129.7	F	F
	Northbound Left	8.6	8.8	A	A	9.5	9.9	A	A
South Bedford Street at Park Avenue	Westbound Left	71.3	89.8	F	F	766.9	1064.1	F	F
	Westbound Right	13.8	12.6	B	B	21.2	17.5	C	C
	Southbound Left	9.3	9.0	A	A	10.8	10.6	B	B

Table 4-3: Park Avenue Improvement/Relocation LOS Summary 2040 Preferred Alternatives

Intersection	Approach/ Movement(s)	2040 Build Conditions (Without Improvements)				2040 Build Conditions (With Improvements)			
		Delay (sec)		Level of Service		Delay(sec)		Level of Service	
		AM	PM	AM	PM	AM	PM	AM	PM
US 113 at Shortly Road / South Bedford Street	Eastbound	172.6	77.2	F	E	172.6	77.2	F	E
	Westbound	63.9	69.9	E	E	63.9	69.9	E	E
	Northbound	37.0	45.2	D	D	37.0	45.2	D	D
	Southbound	26.6	73.7	C	E	27.5	75.3	C	E
	Overall Int.	*47.5*	*63.6*	*D*	*E*	*47.8*	*64.4*	*D*	*E*
US 113 at Arrow Safety Road	Eastbound	52.1	55.1	D	E	50.4	53.2	D	D
	Westbound	509.3	321.5	F	F	39.1	49.9	D	D
	Northbound	42.1	57.7	D	E	46.3	49.5	D	D
	Southbound	36.9	25.6	D	C	29.1	27.7	C	C
	Overall Int.	*118.5*	*70.9*	*F*	*E*	*38.4*	*39.0*	*D*	*D*
US 9 at Park Avenue	Eastbound	7.6	10.3	A	B	7.3	11.3	A	B
	Westbound	144.0	218.0	F	F	8.8	11.7	A	B
	Northbound	25.8	26.2	C	C	17.2	15.9	B	B
	Overall Int.	*79.6*	*99.1*	*E*	*F*	*9.3*	*12.3*	*A*	*B*
South Bedford Street at Zoar Road	Zoar Road Through/Left	223.6	41.7	F	E	223.6	41.7	F	E
	Southbound Left	10.0	9.9	B	A	10.0	9.9	B	A
South Bedford Street at Arrow Safety Road/Park Avenue (Relocated) - *signalized*	Eastbound	40.1	39.3	D	D	40.1	39.3	D	D
	Westbound	31.9	30.1	C	C	31.9	30.1	C	C
	Northbound	24.0	21.5	C	C	24.0	21.5	C	C
	Southbound	18.9	18.5	B	B	18.9	18.5	B	B
	Overall Int.	*25.9*	*23.8*	*C*	*C*	*25.9*	*23.8*	*C*	*C*

4.2 Mobile Source Air Toxics

On October 18, 2016, FHWA issued updated interim guidance regarding MSATs in a NEPA analysis to include the EPA's recent MOVES2014a emission model along with updated research on air toxic emissions from mobile sources including the addition of two compounds identified as significant contributors from mobile sources; Acetaldehyde and Ethylbenzene (FHWA, 2016b). The guidance includes three categories and criteria for analyzing MSATs in NEPA documents:

1. No meaningful MSAT effects,
2. Low potential MSAT effects, and
3. High potential MSAT effects.

A qualitative analysis is required for projects that meet the low potential MSAT effects criteria while a quantitative analysis is required for projects meeting the high potential MSAT effects criteria.

Projects with Low Potential MSAT Effects are described as:

- Those that serve to improve operations of highway, transit, freight without adding substantial new capacity or without creating a facility that is likely to significantly increase emissions. This category covers a broad range of project types including minor widening projects and new interchanges, such as those that replace a signalized intersection on a surface street or where design year traffic is not projected to meet the 140,000 to 150,000 AADT criteria.

Projects with High Potential MSAT Effects must:

- Create or significantly alter a major intermodal freight facility that has the potential to concentrate high levels of diesel particulate matter in a single location;
- Create new or add significant capacity to urban highways such as interstates, urban arterials, or urban collector-distributor routes with traffic volumes where the AADT is projected to be in the range of 140,000 to 150,000 or greater by the design year; and,
- Proposed to be located in proximity to populated areas.

In accordance with the latest MSAT guidance, the area of the Preferred Alternative is best characterized as a project with "low potential MSAT effects" since projected design year traffic is expected to be well below the 140,000 to 150,000 AADT criteria. Specifically, the Design Year Preferred Alternative is expected to have the highest AADT volume of 36,200 along US 113, from Shortly Road to Arrow Safety Road. **Table 4-1** (above) summarizes the expected AADT along each of the segment links throughout the project corridor. The results demonstrate that the forecast AADT volumes would be much less than the 140,000 to 150,000 AADT MSAT criteria. As a result, a qualitative assessment of MSAT emissions projections was conducted for the affected network consistent with FHWA guidance.

4.2.1 MSAT Background

Controlling air toxic emissions became a national priority with the passage of the CAAA of 1990, whereby Congress mandated that the EPA regulate 188 air toxics, also known as hazardous air pollutants (HAPs). The EPA assessed this expansive list in its rule on the Control of Hazardous Air Pollutants from Mobile Sources (Federal Register, Vol. 72, No. 37, page 8430, February 26, 2007), and identified a group of 93 compounds emitted from mobile sources that are part of EPA's Integrated Risk Information System (IRIS) 2011 National Air Toxics Assessment (NATA) (NATA, 2011). In addition, EPA identified nine compounds with significant contributions from mobile sources that are among the national and regional-scale cancer risk drivers, or contributors, and that are non-cancer hazard contributors from the 2011 NATA (NATA, 2011). These are 1,3-butadiene, acetaldehyde, acrolein, benzene, diesel particulate matter (diesel PM), ethylbenzene, formaldehyde, naphthalene, and polycyclic organic matter. While FHWA considers these the priority mobile source air toxics, the list is subject to change and may be adjusted in consideration of future EPA rules.

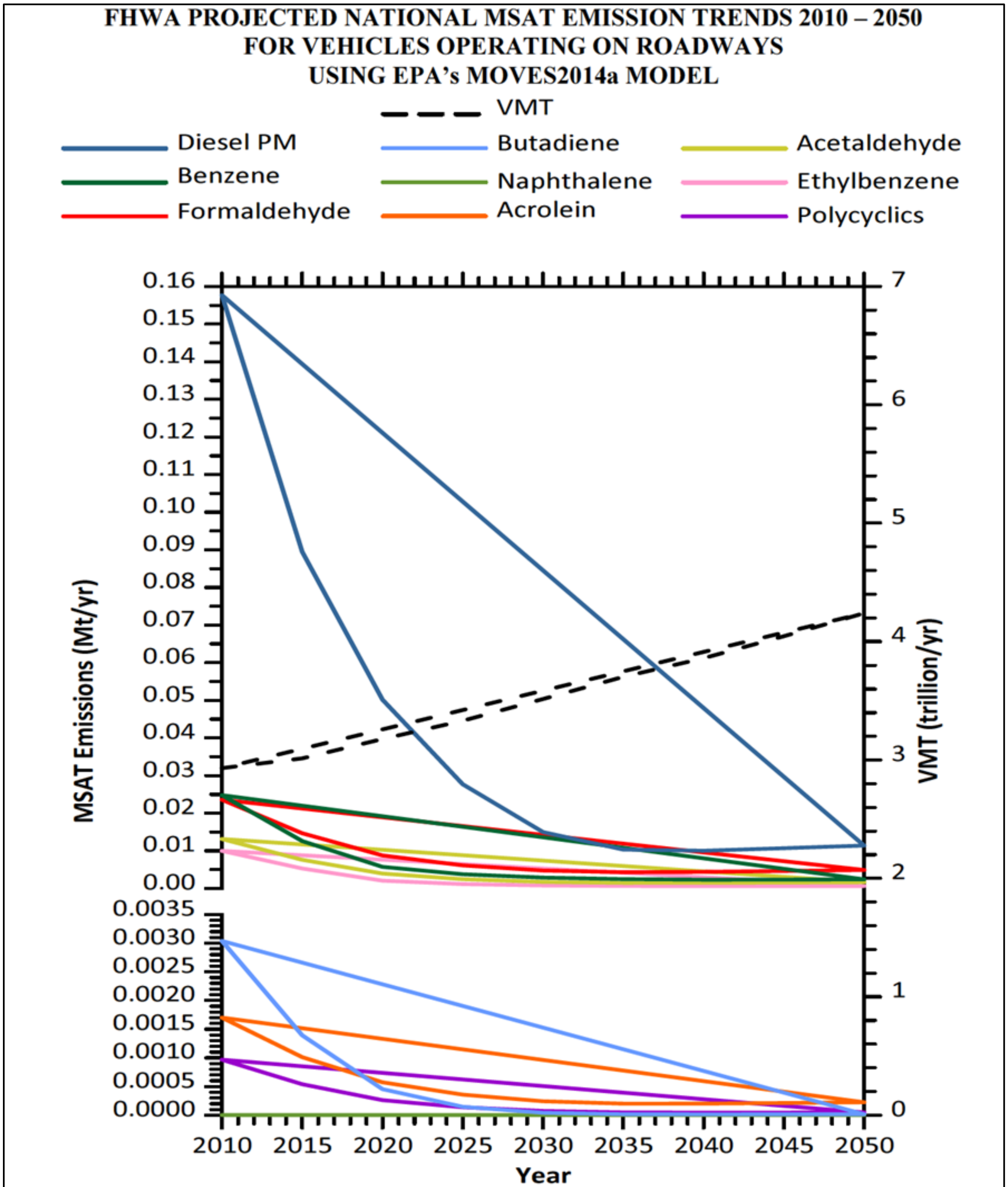
4.2.2 MOVES

According to EPA, MOVES2014 is a major revision to MOVES2010 and improves upon it in many respects. MOVES2014 includes new data, new emissions standards, and new functional improvements and features. It incorporates substantial new data for emissions, fleet, and activity developed since the release of MOVES2010. These new emissions data are for light- and heavy-duty vehicles, exhaust and evaporative emissions, and fuel effects. MOVES2014 also adds updated vehicle sales, population, age distribution, and vehicle miles traveled (VMT) data. MOVES2014 incorporates the effects of three new federal emissions standard rules not included in MOVES2010. These new standards are all expected to impact MSAT emissions and include Tier 3 emissions and fuel standards starting in 2017 (79 FR 60344), heavy-duty greenhouse gas regulations that phase-in during model years 2014-2018 (79 FR 60344), and the second phase of light duty greenhouse gas regulations that phase-in during model years 2017-2025 (79 FR 60344). Since the release of MOVES2014, EPA has released MOVES2014a. In the November 2015 MOVES2014a Questions and Answers Guide, EPA states that for on-road emissions, MOVES2014a adds new options requested by users for the input of local VMT, includes minor updates to the default fuel tables, and corrects an error in MOVES2014 brake wear emissions (EPA, 2015b). The change in brake wear emissions results in small decreases in PM emissions, while emissions for other criteria pollutants remain essentially the same as MOVES2014.

Using EPA's MOVES2014a model, as shown in **Figure 4-1**, FHWA estimates that even if VMT increases by 45 percent from 2010 to 2050 as forecast, a combined reduction of 91 percent in the total annual emissions for the priority MSAT is projected for the same time period.

Diesel PM is the dominant component of MSAT emissions, making up 50 to 70 percent of all priority MSAT pollutants by mass, depending on calendar year. Users of MOVES2014a will notice some differences in emissions compared with MOVES2010b. MOVES2014a is based on updated data on some emissions and pollutant processes compared to MOVES2010b and also reflects the latest federal emissions standards in place at the time of its release. In addition, MOVES2014a emissions forecasts are based on lower VMT projections than MOVES2010b, consistent with recent trends suggesting reduced nationwide VMT growth compared to historical trends.

Figure 4-1: National MSAT Emission Trends 2010-2050 for Vehicles Operating on Roadways Using EPA's MOVES 2014a Model



Note: Trends for specific locations may be different, depending on locally derived information representing vehicle-miles travelled, vehicle speeds, vehicle mix, fuels, emission control programs, meteorology, and other factors

Source: EPA MOVES2014a model runs conducted by FHWA, September 2016.

4.2.3 MSAT Research

Air toxics analysis is a continuing area of research. While much work has been done to assess the overall health risk of air toxics, many questions remain unanswered. In particular, the tools and techniques for assessing project-specific health outcomes as a result of lifetime MSAT exposure remain limited. These limitations impede the ability to evaluate how potential public health risks posed by MSAT exposure should be factored into project-level decision-making within the context of NEPA.

Nonetheless, air toxics concerns continue to be raised on highway projects during the NEPA process. Even as the science emerges, we are duly expected by the public and other agencies to address MSAT impacts in our environmental documents. FHWA, EPA, the Health Effects Institute (HEI), and others have funded and conducted research studies to try to more clearly define potential risks from MSAT emissions associated with highway projects. The FHWA will continue to monitor the developing research in this field.

4.2.4 MSAT Analysis

As shown in **Table 4-1**, the AADT (in total) estimated for the Preferred Alternative is essentially the same or slightly lower than that for the No-Build Alternative due to the proposed improvements and redistribution of traffic along some of the affected links. In general, based on the forecast AADT, MSAT emissions associated with the Preferred Alternative are expected to remain the same when compared to the No-Build Alternative. Because the estimated AADT under each of the Alternatives are nearly the same, it is expected there would be no appreciable difference in overall MSAT emissions between the design year alternatives. In addition, regardless of the alternative chosen, emissions will likely be lower than present levels in the design year as a result of EPA's national control programs that are projected to reduce annual MSAT emissions by over 80 percent between 2010 and 2050. Local conditions may differ from these national projections in terms of fleet mix and turnover, VMT growth rates, and local control measures. However, the magnitude of the EPA-projected reductions is so great (even after accounting for VMT growth) that MSAT emissions in the study area are likely to be lower in the future in nearly all cases.

4.2.5 Incomplete or Unavailable Information for Project-Specific MSAT Health Impacts Analysis

In FHWA's view, information is incomplete or unavailable to credibly predict the project-specific health impacts due to changes in MSAT emissions associated with a proposed set of highway alternatives. The outcome of such an assessment, adverse or not, would be influenced more by the uncertainty introduced into the process through assumption and speculation rather than any genuine insight into the actual health impacts directly attributable to MSAT exposure associated with a proposed action.

The EPA is responsible for protecting the public health and welfare from any known or anticipated effect of an air pollutant. They are the lead authority for administering the CAA and its amendments and have specific statutory obligations with respect to hazardous air pollutants and MSAT. The EPA is in the continual process of assessing human health effects, exposures, and risks posed by air pollutants. They maintain IRIS, which is "a compilation of electronic reports on specific substances found in the environment and their potential to cause human health effects" (EPA, 2017a). Each report contains assessments of non-cancerous and cancerous effects for individual compounds and quantitative estimates of risk levels from lifetime oral and inhalation exposures with uncertainty spanning perhaps an order of magnitude.

Other organizations are also active in the research and analyses of the human health effects of MSAT, including the HEI. Two HEI studies are summarized in Appendix D of FHWA's Interim Guidance Update on Mobile Source Air Toxic Analysis in NEPA Documents. Among the adverse health effects linked to MSAT compounds at high exposures are cancer in humans in occupational settings, cancer in animals, and irritation to the respiratory tract, including the exacerbation of asthma. Less obvious is the adverse human health effects of MSAT compounds at current environmental concentrations or in the future as vehicle emissions substantially decrease (HEI, 2007).

The methodologies for forecasting health impacts include emissions modeling, dispersion modeling, exposure modeling, and then final determination of health impacts, with each step in the process building on the model predictions obtained in the previous step. All are encumbered by technical shortcomings or uncertain science that prevents a more complete differentiation of the MSAT health impacts among a set of project alternatives. These difficulties are magnified for lifetime (i.e. 70 years) assessments, particularly because unsupportable assumptions would have to be made regarding changes in travel patterns and vehicle technology (which affects emissions rates) over that time frame, since such information is unavailable.

It is particularly difficult to reliably forecast 70-year lifetime MSAT concentrations and exposure near roadways to (1) determine the portion of time that people are actually exposed at a specific location; and (2) establish the extent attributable to a proposed action especially given that some of the information needed is unavailable.

There are considerable uncertainties associated with the existing estimates of toxicity of the various MSAT, because of factors such as low-dose extrapolation and translation of occupational exposure data to the general population, a concern expressed by HEI (HEI, 2007).

As a result, there is no national consensus on air dose-response values assumed to protect the public health and welfare for MSAT compounds, and in particular for diesel PM. The EPA and the HEI have not established a basis for quantitative risk assessment of diesel PM in ambient settings (EPA, 2017d) and HEI, 2017).

There is also the lack of a national consensus on an acceptable level of risk. The current context is the process used by the EPA as provided by the CAA to determine whether more stringent controls are required in order to provide an ample margin of safety to protect public health or to prevent an adverse environmental effect for industrial sources subject to the maximum achievable control technology standards, such as benzene emissions from refineries. The decision framework is a two-step process. The first step requires EPA to determine an "acceptable" level of risk due to emissions from a source, which is generally no greater than approximately 100 in a million. Additional factors are considered in the second step, the goal of which is to maximize the number of people with risks less than 1 in a million due to emissions from a source. The results of this statutory two-step process do not guarantee that cancer risks from exposure to air toxics are less than 1 in a million; in some cases, the residual risk determination could result in maximum individual cancer risks that are as high as approximately 100 in a million. In a June 2008 decision, the U.S. Court of Appeals for the District of Columbia Circuit upheld EPA's approach to addressing risk in its two-step decision framework. Information is incomplete or unavailable to establish that even the largest of highway projects would result in levels of risk greater than deemed acceptable.

Because of the limitations in the methodologies for forecasting health impacts described, any predicted difference in health impacts between alternatives is likely to be much smaller than the uncertainties associated with predicting the impacts. Consequently, the results of such assessments would not be useful to decision makers, who would need to weigh this information against project benefits, such as reducing traffic congestion, accident rates, and fatalities, in addition to improved access for emergency response, that are better suited for a quantitative analysis.

4.2.6 MSAT Conclusions

What we know about MSATs is still evolving. Information is currently incomplete or unavailable to credibly predict the project-specific health impacts due to changes in MSAT emissions associated with the Preferred Alternative. In summary, with the Preferred Alternative in the design year, no significance difference is expected with MSAT emissions to occur in the immediate area of the project, relative to the No-Build Alternative. EPA's vehicle and fuel regulations are expected to result in significantly lower MSAT levels in the future than exist today due to cleaner engine standards coupled with fleet turnover. The magnitude of the EPA-projected reductions is so great that, even after accounting for VMT growth, MSAT emissions in the study area would be significantly lower in the future than they are today, regardless of the Preferred Alternative chosen.

5.0 Construction Emission Analysis

The temporary air quality impacts from construction activities are not expected to be significant and consist primarily from diesel powered construction equipment and fugitive dust. Construction activities will be performed in accordance with DelDOT’s 2004 Road Design Manual (DelDOT, 2004). The specifications require compliance with all applicable local, state, and federal regulations. Measures will also be taken to minimize exposed earth by stabilizing with grass, mulch, pavement, or other cover as early as possible, applying water as a stabilizing agent to working or haulage areas, covering, shielding, or stabilizing of stockpiled materials as necessary, and the use of covered trucks.

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